



Original communication

How reliable is external examination in identifying internal injuries – Casper's sign revisited

Roger W. Byard MD, Professor ^{a,b,*}^a Discipline of Anatomy and Pathology, The University of Adelaide, Level 3 Medical School North Building, Frome Road, Adelaide, SA 5005, Australia^b Forensic Science SA, Adelaide, SA 5000, Australia

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ABSTRACT

It has been proposed that the absence of injuries to the outside of a body that has been subject to blunt trauma indicates that the forces involved were relatively minor. It has also been suggested that an autopsy will be unlikely to uncover any significant injuries. A series of cases involving lethal blunt trauma from vehicle crashes and falls are described where minimal external injuries were associated with major disruption of internal organs. Skin is both resilient and elastic enabling it to resist injury, while allowing considerable forces to be transmitted to the musculoskeletal system and internal organs beneath. The absence of external injury is not, therefore, synonymous with lesser degrees of force, and should not discourage full medicolegal investigation of cases where occult trauma may be a possibility. As Casper was one of the earliest to describe this phenomenon, perhaps the term 'Casper's sign' should be used when massive internal injuries from blunt trauma are found in the absence of significant injuries to the skin.

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1. Introduction

A question that not uncommonly arises in court in cases of lethal inflicted blunt trauma injury involves the absence of significant injuries to the exterior of the body. The hypothesis that is often put to the pathologist is that the lack of injuries to the outside of the body implies that the forces involved were much less than has been suggested. The basis of this proposition is a lack of understanding of the resiliency and elasticity of skin and subcutaneous tissues that enable them to resist injury, while allowing considerable forces to be transmitted to the musculoskeletal system and internal organs beneath. To clarify this issue for the courts two studies were undertaken.

2. Materials and methods

Firstly, a retrospective search was undertaken of the author's autopsy files at Forensic Science SA, Australia, for representative examples where extensive internal disruption had occurred from blunt trauma with minimal external evidence of injury (Cases 1 and 2).

Secondly, an English translation of the text by Prof Casper in Berlin, Prussia,¹ was reviewed for details of similar cases, the features of which are summarized below (Cases 3, 4 and 5).

3. Results

Case 1: A young male driver was involved in a motor vehicle crash. Minor superficial abrasions were observed involving the limbs and the left side of the neck. There were no injuries to the skin of the chest, abdomen or head. Internal examination, however, revealed aortic transection, rib fractures with lung laceration, hemothoraces, contusion of the heart, bilateral ruptures of the diaphragm, laceration of the liver, parenchymal disruption of the spleen and fracture dislocation of the left sacroiliac joint and ischium. There was also subarachnoid hemorrhage with intraparenchymal hemorrhage of the brain. Death was attributed to multiple injuries.

Case 2: An adult male driver was involved in a motor vehicle crash. Lacerations and minor superficial abrasions were observed involving the head and limbs. There were no injuries to the skin of the chest or abdomen (Fig. 1). Internal examination, however, revealed a fracture of the sternum and multiple bilateral rib fractures with a flail chest and lacerations of the left lung. There were also lacerations of the spleen with surrounding hemorrhage, transection of the aorta with bilateral hemothoraces and fracture dislocation of the right sacroiliac joint with separation of the pubic symphysis. There was fracture dislocation of the atlanto-occipital joint with transection of the upper cervical cord, and fracture-dislocation of thoracic vertebra 3 with transection of the thoracic spinal cord. Death was attributed to multiple injuries.

* Tel.: +61 8 8303 5441; fax: +61 8 8303 4408.

E-mail address: roger.byard@sa.gov.au.

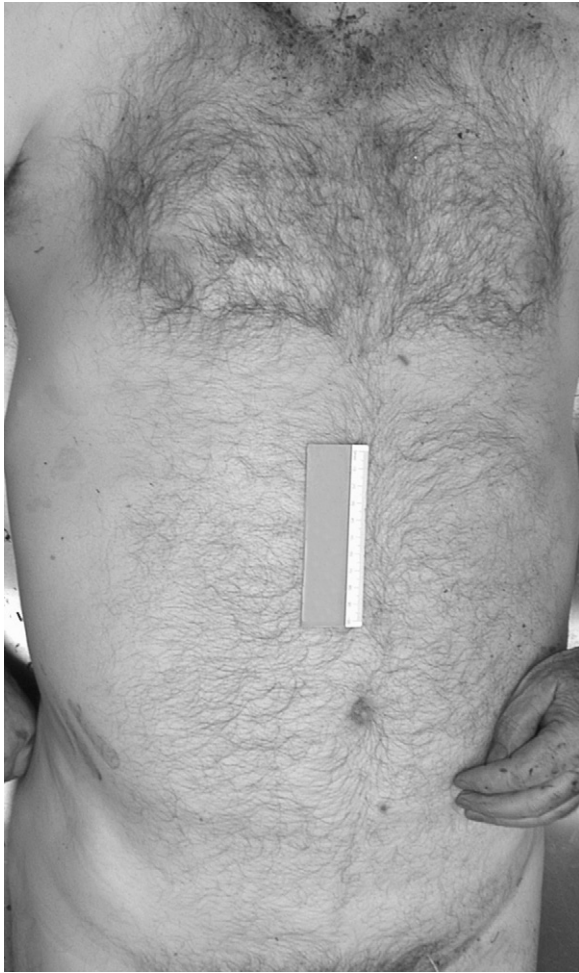


Fig. 1. A completely normal torso externally in a victim of a motor vehicle crash with no external evidence of injury to the chest or abdomen. A superficial abrasion was present over the tip of left shoulder and blood smearing can be seen over the right hip from a superficial laceration of the back of the right hand. In contrast, internal examination revealed serious injuries to the sternum, ribs, left lung, spleen, aorta and pelvis.

Case 3: “A coachman had fallen from his carriage during severe frost”. External examination revealed no evidence of injury. Internal examination however revealed laceration of the liver with complete separation of the right lobe and a hemoperitoneum. There was also fracture of the sternum and the lower five ribs on the right side.¹

Case 4: “By a too common act of carelessness a wealthy brewer met with a terrible death” falling in the dark through a trapdoor into a cellar. He sustained a laceration of the scalp with skull fracture and intracranial hemorrhage. Despite no other external injuries he had also sustained lacerations to the liver, spleen and pericardial sac, with rib fractures.¹

Case 5: “An aged tailor was run over and killed”. Despite there being “not the slightest trace of injury externally” he had sustained an extensive fracture of the skull with subdural hemorrhage, “rupture of the brain” and intracerebral hemorrhage.¹

4. Discussion

The skin may be an excellent source of information on the nature of the blunt trauma that has impacted a body. Classical examples include tire tread marks, human bites and patterned

injuries that mirror the features of a blunt object.² However, as review of cases from Adelaide, Australia, and Berlin, Prussia, have demonstrated, this is not always the case.

Professor Johann Casper was one of the first to address this issue in the mid-nineteenth century. He expressed concerns that “traces of external injury wanting” may lead to the mistaken conclusion that there must therefore be no significant internal injuries, and so a medicolegal examination is not warranted.¹ In his words “the actual truth is precisely the reverse” and he emphasized that “an autopsy apparently unnecessary from the absence of the external marks of violence, is in truth most needful”. Certainly the above cases support his position.

The obvious question to ask is why there can be such dysynchrony between external and internal findings. While it is unusual to have absolutely no external injuries when there are serious internal injuries, these often take the form of very minor and superficial abrasions with no bruising. In the chest there may be only very superficial abrasions, or no injuries to the skin overlying the chest cavity, despite the subsequent autopsy revealing multiple bilateral rib fractures, a flail chest, bilateral hemothoraces, contusions and lacerations of the lungs, lacerations of the heart and the fracture-dislocation of the vertebral column. Similarly in the abdomen there may be no external markings despite traumatic disruption of the liver and spleen with bruising and tearing of the mesentery with a large hemoperitoneum. The latter is a well recognized occurrence in cases of lethal child abuse.³

A major point involves the difference in structure and location between the skin and the internal organs. Characteristics of skin include its elasticity and deformability,⁴ both of which result in skin being able to move with blunt trauma, rather than resisting the applied force and thereby sustaining injury. Internal organs such as the liver are not particularly elastic and are tethered by blood vessels and fascia so that they are not able to move out of the way of an intruding blunt object. The same applies to the spleen, pancreas and parts of the intestine such as the duodenum, which may lie immobile between the spine and an impacting force. Parenchymal disruption with significant hemorrhage is the most likely outcome in such cases. The rib cage has some degree of elasticity but will tend to fracture with high force injuries that may also cause lacerations to the lungs and heart, the latter sometimes associated with deceleration injuries that may also involve the aorta. Certainly the degree of external injury tends to be site dependent with the skin of the abdomen being more resilient than the skin of the head which is stretched over the unyielding bones of the skull and so tends to split (lacerate) on impact. The scalp may, however, also show no evidence of injury despite considerable craniocerebral disruption, as was described in case 5.

Other features that may protect the skin from manifesting injury are the interposition of clothing which may have a protective effect. In addition, massive and rapid exsanguination (either internal or external) with loss of blood pressure and volume may prevent the development of bruises.¹ Individuals may also have different susceptibility to bruising, with such an idiosyncratic response to injury being shown histologically by a delay in the inflammatory response to bruising in some cases for more than 72 h after an injury.⁵

In conclusion, these cases demonstrate that significant and lethal tissue and organ damage can be sustained from blunt trauma with minimal external evidence of injury. The absence of external injury is not, therefore, synonymous with lesser degrees of force, and should not discourage full medicolegal investigation of cases where occult trauma may be a possibility. Given Professor Casper's early work in this area and his legacy to academic forensic pathology, perhaps it would be appropriate to use the term

'Casper's sign' when massive internal injuries from blunt trauma are found in the absence of significant injuries to the skin.

Conflicts of interest

None.

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None.

Ethical approval

Forensic Science SA.

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